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Forms of Some Philippine Fruits

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The growing of fruits can be regarded at present as one of the undeveloped agricultural industries in the Philippines. There is only one considerable area which is economically dependent upon fruit culture, and that is the orange district of Tanauan, Batangas.[1] The commercial possibilities of growing in the Philippines most, if not all, of the important tropical and semi-tropical fruits are great. We have land and climate highly favorable to their culture and large areas can well be devoted to them, yet, as for rice, coffee, cacao, etc., we are dependent upon other countries for much of our market supply.

From an economic standpoint, there are existing conditions which would indicate the importance of developing a fruit industry in the Philippines. Our local production of good fruits is at present far short of satisfying our market demands. This not only causes a scarcity in the supply, which must be met by fruits from other countries, but also reduces the possible consumption of fruits on account of high cost. We are acquiring tastes and habits which promote greater consumption of fruits, which means an increasing demand. To meet this demand economically and abundantly we should produce fruits in greater quantities and of better qualities. Many tropical countries have a large and increasing annual exportation of bananas, citrus fruits and pineapples. It is probable that the growing of mangoes, lanzones, papayas and other tropical fruits for export will in time be an industry in these Islands.

Fruit growing has already assumed a prominent position as a world industry. The growing of improved and specialized varieties, better methods of culture and care of orchards, better methods of handling, shipping and marketing the fruits are all factors which have promoted fruit consumption. Fruit products and even fresh fruits are now commodities which are interchanged from

one end of the world to the other, and their production may easily become of great economic importance in any region where the climate is favorable.

The increasing use of fruits is probably due largely to a wider recognition of their peculiar value as a food article. People are awakening to the fact that fruit is a valuable addition to the diet. The development of the American national breakfast, from a no-fruit diet to a diet containing fruits, has been mentioned as one of the most "noteworthy phenomena" during the last decade.[2] It is said that fruits supply 4.4% of the total food and 3.7% of the total carbohydrates in the average American diet.[3] Fruits are probably eaten primarily for their palatability, and secondarily for their hygienic properties. Synder[4] says that the organic acids, essential oils, and soluble mineral compounds, together with the digestible form in which the nutrients are present give them their unique value. The organic acids and essential oils impart palatability and help in the digestive processes, while certain fruits, like the papaya and the pineapple, contain proteolytic ferments which directly aid in the digestion. Langworthy[5] says that most fruits have laxative properties and stimulate what might be called sluggish intestines. Fruits may also supply certain minerals essential to the human body. Since fruits are dilute foods they can be eaten in large quantities to supply those minerals. The use of the apple has also been mentioned as one of the cures for alcoholism. Fresh fruits are dilute foods, but dried fruits are concentrated. One interesting fact in connection with their use is the high digestibility of their food-contents. Jaffa[6] notes that some persons have actually lived well for several years on an exclusive fruit-and-nut diet.

Present indications in the Philippines promise the awakening of a greater interest in fruit growing in the near future. The Arbor Day program in our schools is one means of interesting the coming people in the planting of useful fruit trees. The growing of permanent plantings is being urged upon the people, not only as a means of acquiring an additional source of wealth but also as a means of tying people to the land. Considerable work has been done by the government within the last three of four years toward the improvement of fruits here by introducing many improved and standard varieties from tropical and semi-tropical countries. While some of these varieties have already given promise of success here, their real commercial possibilities in the different parts of the Philippines cannot as yet be definitely known. At least one variety of pineapple—the Cayenne —has proven to be so superior over the native varieties that there is no doubt as to its adaptability to the Philippines. But the most noteworthy event in the history of fruit growing in the Philippines is the recent development of proper methods of vegetative propagation applicable to our species of fruits; these methods may be said to constitute the "cornerstone of modern fruit culture" in the Archipelago.

One of the most important problems to be considered in the development of a fruit industry in the Philippines is the improvement of varieties to be grown. True, the proper management and culture of orchards, careful and systematic methods of handling, shipping, and marketing the fruits, effective means of fighting diseases and insect pests, and the establishment of nurseries that would grow only the varieties best adapted to the Islands, are all important and must be considered. But the general inferiority of Philippine fruits, due largely to the existence of a

greater number of poorer types than good ones, must be remedied first. We should grow only the best types of fruits and eliminate the poor ones, thus insuring not only greater consumption of the products, but also more profit to the producer.

The work in improvement of varieties of fruits which is being carried on at present in the Philippines may be divided into two divisions: 1—Testing and selection of foreign varieties. 2—Selection from among our native stock. Each of these two classes of materials, i. e., foreign varieties and native stock, may be either the direct source of varieties desirable for growing or of varieties for breeding and further improvement. Breeding work has not yet been started in the Philippines; but when more materials are collected and have become better known, it is hoped that work along this line will be carried on.

Very little systematic effort has yet been made in the selection of our native fruits. Wester[7] in connection with his study of the Philippine citrus, has found four varieties of the mandarin, four of tizon and one pomelo that merit general dissemination. Work along this line with Philippine bananas and citrus varieties is being done in the College of Agriculture.

The present study is an attempt to show the importance of improving our varieties of fruits by the selection of the best native forms and propagating them vegetatively. This improvement cannot be even begun until the more desirable forms are located and made known. A knowledge of the kinds of material we have on hand will greatly facilitate and help further work in breeding, and a direct improvement of the varieties to be grown may be accomplished by singling out the best forms and growing them. The seedling origin of practically all the trees growing in the Islands promises a rich field for selection. This study is the result of a brief survey and has been of necessity confined to a very limited area. A more comprehensive survey extending throughout the Islands will no doubt reveal the existence of many exceptionally valuable forms. Descriptions are here given of the more striking forms found in the province of Laguna during 1915 and the first quarter of 1916. The different types of mangoes were obtained during June, 1915, mostly from Malabon and its barrios, in Cavite province.

In the Philippines, there is probably no other group of cultivated plants whose commercial values are so directly affected by its various types as that of fruits. Growers of fruits have never attached much commercial importance to the industry. No efficient effort toward the selection of the best forms of fruits and the elimination of the poorer ones has been made. Consequently, our fruits are very variable, with a large percentage of very poor types among them. The fruits of different types are specially variable in flavor. Since fruits are generally eaten for their good flavor, wide variation in this characteristic means a wide divergence in economic values. To illustrate this point, the mango in the Philippines is well known for its excellent flavor and quality. But only the best varieties have these characteristics. It is fortunate that the greater number of trees are of the two excellent varieties—the Carabao and the Pico—and that their fruits are the ones most commonly met. But while these two varieties are well known, there are several other varieties which are rarer and which generally do not reach the larger markets. The Chupadera, which ranks about third in importance, is not at all a good variety, its fruit being small with a large, very fibrous seed. And the Saheng, which is well known in

Cavite, and a form represented by a tree among Picos in Vigan, Ilocos Sur, are extremely poor kinds of mangos, the former having a pronounced terebenthine odor, and the latter being decidedly inedible, although it resembles the Pico in shape. Another rare variety, the Corazon (from Malabon), is easily superior to the Pico or the Carabao in flavor and quality, and the trees are also good bearers. A comparison of the selling price of pomelos of different varieties may furnish another good illustration. Ordinary pomelos sell at about two or three centavos apiece. There are trees, however, whose fruits resemble very closely the imported Chinese pomelo in size, flavor and quality. Chinese pomelos sell at from 15 to 25 centavos in Manila.

The variable character of native fruits and the scarcity of excellent and well-established varieties of each of the species grown are two conspicuous features of Philippine fruit-growing. It is a common belief among the people that the inferiority of Philippine fruits is due to the unsuitability of the soil. But it is not unusual that one eats or hears of some exceptionally good kinds of nangka, santol, atis, pomelo, lanzones, mabolo, etc., which are borne by trees in the midst of trees bearing only the ordinary poor kinds of fruits. And there are now evidences in the Philippines that imported varieties have borne fruits very similar in quality to those of the same varieties grown in other places, and superior to the native sorts grown side by side with them. Wide differences in the quality of fruits should perhaps be attributed to the variety and methods of propagation rather than primarily to the soil.

Perhaps no other feature of modern fruit-growing is more important than the practice of vegetative propagation. Upon this rests the success of bud selection and the standardization of varieties. It is a well known fact in pomology that this kind of propagation is the most accurate means of reproducing the characters of a parent tree. While the value of selection is probably generally recognized in the Philippines, when it comes to selecting and propagating a good type the seed is almost always looked to for its reproduction, whereas the use of seed in modern fruit-growing is confined almost solely to the growing of stocks or to breeding work. The ancient use of vegetative propagation in India, China, Europe and other lands has enabled them to fix and propagate many desirable forms which have appeared from time to time, so that to-day these countries have very many exceptional varieties of fruits well established in cultures.

It is unfortunate that in the Philippines the better methods of vegetative propagation were not known in the past and their advantages recognized. Budding and grafting are arts that never have been practiced in this country. Marcottages and cuttings were used on certain plants, where these methods easily succeeded, but the methods of operation were commonly not properly carried out. Propagation by seed has always been preferred.

The advantages of vegetative propagation are so many and so great that it should always be used whenever possible. It is encouraging to know that within the last few years definite knowledge has been gained regarding the application of the better methods of vegetative propagation to Philippine fruits. The rapid popularization of these methods, together with active selection work, will no doubt bring about a reformation in the methods of fruit-growing in the Islands.

In the following descriptions the term "form" has been used somewhat arbi-

trarily. Bailey defines the word "form" as "a minor variety, usually transient, produced by some local environment," and the word "variety" as "a form or a series of forms of a species marked by characters of less permanence or less importance than are the species themselves." Wester has defined "variety" in a pomological sense, as "a group of plants propagated vegetatively from one original plant producing fruit of a distinctive appearance, texture, flavor, or aroma, by which characters it may be distinguished from fruit of other trees of the same species." The materials dealt with in this paper, with the exception of the chico and the ciruelas, are all of seedling origin, and the descriptions do not necessarily apply to a group of plants; hence, it is clear that the pomological sense of the word "variety" can only be applied correctly to cultures of those two species. The word "type," a botanical term, is used in pomology with various meanings. Its use in these descriptions has not been attempted. The word "form" has been applied in the following descriptions to distinguish an individual tree, seedling or vegetatively propagated plant whose fruits have markedly differing characters from those of other trees of the same species. Any of these forms, when they will have been well established in culture through vegetative propagation, can be called horticultural varieties.

Achras Sapota
Chico, Sapodilla

The chico is a fruit that is highly esteemed by Filipinos. Its sweet, juicy and tender flesh with its pleasant aroma, make it, in its best forms, undoubtedly one of the most delicious fruits of the world. The belief, however, that it is the most delicious is probably too high an estimate of the fruit in its ordinary forms, for some writers have accorded the mangosteen, the pineapple, and the cherimoya the places of the three best fruits of the world; and in the Philippines many people would place the mango above the chico.

In Laguna the chico is usually abundant in the market during the months from August to November, and it is also available in April and May, when the fruits of the second season are gathered. Trees, however, may be found which mature fruit at other times of the year, and by selection toward off-season fruiting many more trees may perhaps be grown which would supply the market at other times than the regular seasons. Most of the chicos produced are sold locally at a relatively high price.

The trees are fairly productive. They are universally propagated by marcottage, which process takes about a year. Budding or grafting the chico on seedlings may perhaps be a better and quicker way of propagating it than marcottage. In Laguna the people believe that the seed does not grow; but by cracking the shell before sowing it is made to germinate within three weeks.

In some countries of tropical America gum chicle, which is the dried latex of the plant, is an article of commerce of considerable importance. Many more trees are perhaps needed in the Philippines to develop a gum chicle industry.

There are two groups of chico forms in Laguna. These are distinguished by the shape of the fruit, and texture, flavor and juiciness of the flesh.

GROUP I

The fruits are oblong-ovate, small to medium in size, ranging in weight from about 30 to 75 grams; skin thin, flesh tender, juicy, and fine-textured; flavor in general very good to excellent, sweet and aromatic; seed usually narrow, elongated and thick.

The trees of this group are usually of slender growth. They are not common, and none was found to be very fruitful. Under this group two forms may be distinguished.

FORM NO. 1

Size of fruits medium, about 6 centimeters long, 4.5 cm. in diameter; weight about 60 grams; form oblong-ovoid; stem 2.5 cm. long; base depressed with shallow furrows passing out from cavity; calyx dry, persistent; apex conical; surface rough and scurfy; color brown; skin thin; flesh light-salmon-brown, very tender and juicy; core buff; texture fine; seeds usually 3; flavor very sweet, aromatic; quality excellent.

The samples described were obtained from a tree belonging to Mr. Luis Tangao, barrio of San Antonio, Los Baños, Laguna, April, 1915. This tree is a shy bearer, though robust, fruiting mostly during the second chico season.

FORM NO. 2

The fruit is small; length about 4.6 cm., diameter 3 cm.; weight about 30 grams; form oblong-ovoid; stem slender, about 2.5 cm. long; base full; calyx dry, persistent; apex conical; surface rough; color dark-brown; skin thin; flesh rich-salmon-brown, soft, juicy; core pale-orange; texture fine; seed usually 2; flavor very good, aromatic; quality very good.

The samples were taken from a tree belonging to Mr. Pedro Alcala, Mayondon, Los Baños, Laguna, December 30, 1915. It fruits in the two seasons, though sparingly.

GROUP II

Fruits round-ovate to slightly oblate; size small to large, weighing from about 40 to 125 grams; skin thin; flesh somewhat firmer than those of the other group, juicy; texture usually coarse, having sand-like particles inside; flavor sweet, aromatic; quality good to excellent.

Trees of this group are common in Laguna. They generally make a spreading growth; foliage often not dense. Some forms are excellent and productive.

FORM NO. 3

Fruits medium to large in size; length about 6.2 cm.; diameter 5.7 cm.; weight about 75 grams; form ovoid; stem 2.5 cm. long; cavity slightly depressed, sometimes slightly furrowed; apex broadly conical; surface very rough, scurfy; color dark-brown; skin thin; flesh tender, juicy, light-salmon-brown; core light-orange; texture rather coarse, sandy; seeds generally 2; flavor sweet, aromatic; quality very good.

Trees of this form are generally good bearers, fruiting well in both seasons. The tree from which the sample was obtained belongs to Mrs. Catalina Lauas on Mayondon road, barrio of Mayondon, Los Baños, Laguna, April, 1915.

FORM NO 4. (PLATE I, FIGS. 1 AND 2)

Fruits usually of medium size; length about 6 cm., width 5.5 cm., weight about 75 grams; form ovoid; stem short; base flattened; calyx persistent; lobes adhering; apex broadly conical; surface rough, scurfy; color brown; skin thin; flesh salmon-brown, soft, very juicy; core buff; texture rather fine with a minimum of the granular substance; seeds usually 2; flavor excellent, sweet with a delicate aroma; quality excellent.

The tree of this form belongs to Mrs. Juana Meladellar; is the smaller of two trees near the road; barrio of Anos, Los Baños, Laguna, in December, 1915.

FORM NO. 5

Fruits mostly large in size, averaging about 100 grams; form, round-ovate to slightly oblate; stem of medium size;

base usually depressed; cavity regular; calyx dry, persistent; apex round to conical; surface rough, scurfy; color brown; skin thin; flesh tender, juicy, brownish; core buff; texture coarse, sandy; seeds usually 3; flavor good, sweet and aromatic; quality very good.

Two trees have been found of this form. The samples described were from a tree owned by Mrs. María Lagtican, Anos, Los Baños, Laguna. This tree is considered to be the most productive of all the chico trees examined, considering both size and the number of fruits produced.

Annona muricata

Guanabano, Soursop

The guanabano is one of the three well known Annonaceous fruits in the Philippines. It is generally eaten fresh, but sometimes the mature but hard fruit is candied, making a preserve of a delicate flavor and aroma. In other parts of the tropics, it is said that it is used extensively in the making of cooling drinks. If the fruit contained less fiber and more sugar, it would undoubtedly become a very important dessert fruit.

In Laguna, the guanabano, like the other two Annonas, the anona and the atis, is usually attacked by many very destructive insects which ruin, deform, or reduce the size of the fruits. However, in spite of this fact, the guanabano is often productive. It has a long fruiting season. On account of the vigorous condition of the trees, throughout the year, the guanabano will perhaps make a good stock for the atis and the recently introduced cherimoya.

FORM NO. 1. (PLATE III, FIG. 2)

Fruit about 20 cm. long, 8 cm. thick, 10 cm. wide; weight 800 grams; form, flat-oblong; stem long, slender; base slightly sunken; apex rounded; upper front and back broadly depressed; surface coarse; reticulations marked by a smooth sunken strip with a darker green color; carpids large on the lower half and on the sides; spines withering, of small size; skin thin, dark-green; flesh white, very juicy; texture fibrous; seeds many, about 80, small; quality good.

A small tree, San Antonio, Los Baños, road to Bay. Samples collected April, 1915.

FORM NO. 2

Fruit flat, oblong when not deformed, but usually curved; size medium, about 15 cm. long, 9 cm. thick, and 10.5 cm. wide; stem small; base sunken below the shoulders, apex rounded; surface rough; reticulations faintly marked by a smooth strip which is darker green than the general surface; spines rather large; skin rather thick; flesh white, juicy; texture less fibrous than is usual seeds about 50, small; flavor subacid; sweet, aromatic; quality good.

Collected at Mayondon, Los Baños, Laguna, June, 1915.

Annona reticulata

Anona, Custard Apple

Although the anona does not possess so fine a flavor and delicate aroma as the atis, it is important from the fact that it fruits at a different season than either the atis or the guanabano. In Laguna, anona trees abound but, so far as noted, they are unproductive. This is aggravated by the presence of a moth larva which in 1915 destroyed almost 100% of the fruits. Evidently, better and more productive forms ought to be looked for.

FORM NO. 1

Form irregular, heart-shaped; length about 7 cm., diameter 7.2 cm.; weight about 202 gm.; stem about 12 cm. long, thick; base flat or slightly sunken below the level of the shoulders; basal ring

with diameter about 1.53 cm., height 0.6 cm.; cheeks usually prominent and distinct; apex rounded; surface of a leathery appearance, shiny; reticulations ridged, greenish yellow; carpids sunken; flesh creamy white; texture buttery and granular; seeds small, very variable in number, 35 to more than one hundred; flavor sweet; quality good.

Fruits collected in Los Baños, (Blumentritt Street), April 6, 1915.

Annona squamosa

Atis, Sugar Apple

The atis is the most widely grown of the Annonas in the Philippines, and is of considerable importance. As in the case of the anona, the atis is very susceptible to the attack of the moth larva which works into and destroys the fruits; and mealy bugs are especially fond of the fruit.

The atis has been considered by some to rank with the cherimoya in point of flavor. Its white, syrupy, aromatic flesh of a creamy texture finds general favor. In Laguna it is produced commercially. It is generally planted in home gardens, for family consumption only. Good forms are extremely rare. A commercial culture near large towns would perhaps be very profitable if based upon a rigid bud selection and if it was carefully guarded from insect attacks.

FORM NO. 1

Form round to round-ovate; size small; length about 6–8 cm., diameter about 6–8 cm.; weight about 180 grams; stem medium size; base usually rounded; apex rounded; surface hard; color grayish green; reticulations deeply sunken, often wide, pinkish; carpids hard, easily separated, large; flesh creamy-white; texture fine, melting; seeds small, many; flavor excellent, delicious; quality fair.

Specimens obtained at Los Baños, April, 1915.

Antidesma Bunius

Bignay

The bignay is a tree of common occurrence in the Philippines. It is valued as an ornamental plant, and its fruit is often used in the preparation of various dishes as substitute for tomatoes or vinegar, and it is sometimes eaten fresh. An attractive jelly and a refreshing drink are also made out of the fruit. In the form of jelly, it is said that there is an unpleasant after-taste. At present, most of the fruit is eaten by birds, which are particularly fond of it.

FORM NO. 1. (PLATE III, FIG. 1)

Form round to round obovate, small, about 1.2 cm. long and 1 cm. in diameter; stem short; base rounded; apical point usually depressed; skin thin, reddish brown when mature, and black when ripe; flesh very juicy; seed flattened, with a reticulate coat; flavor agreeable when ripe.

The fruits of this particular form are borne in bunches or racemes, 30-40 each. The tree from which the samples were described is small, not bushy, and has a round, compact crown. Los Baños, Laguna.

Artocarpus integrifolia

Nangka, Jak, Jack Fruit

The nangka is very widely distributed in the Philippines and may perhaps rank next to the mango and the banana in importance. The huge fruit, which often weighs 20 to 30 kilos in the Philippines, but which is said to attain as much as 50 kilos in India, contains 35% edible matter. The soft, fleshy pulp which surrounds the seed is sweet and strongly aromatic. It is very palatable to most people. It is generally eaten fresh, but sometimes it is boiled and preserved in syrup. The seed, when roasted or boiled, is also palatable, and is nutritious.

Several distinct varieties evidently exist in the Philippines. A few varieties are found in Laguna, but the fruits are generally small. The largest variety averaged about 16.5 kg. per fruit, and is of good quality.

FORM NO. 1

Fruit small, short, obovate, or pyriform; length about 34 cm., width, 24 cm. stem short and stout; base flat or slightly depressed at point of stem insertion; apex rounded; surface orange green; rind thick; edible pulp rather thick, long, somewhat deep orange in color; texture firm, tender; seed large, broadly ellipsoid; flavor good, sweet, aromatic; quality good.

Samples described were obtained from a tree belonging to Mr. Basilio Mercado, barrio of Mayondon, Los Baños, Laguna, May 1, 1915.

FORM NO. 2. (PLATE II)

Fruit rather large, long-ellipsoid; length about 60 cm. diameter about 28 cm.; weight 16.5 kg.; stem short and stout; base rounded, slightly sunken at point of stem insertion; apex rounded; surface often irregular, yellowish-green; rind thick; pulp thick and long, of a pale orange color; texture rather firm; seed large, ellipsoid; flavor very good, sweet, aromatic; quality very good.

Samples were obtained from a tree belonging to Mr. Andres, San Antonio, Los Baños, Laguna, June, 1915. The tree is said to bear more than 10 fruits yearly, although its trunk was in an unhealthy condition.

FORM NO. 3

Fruit rather small; ellipsoid; length about 40 cm.; diameter about 23 cm.; stem short, slender; base usually sunken at point of stem insertion; apex rounded; surface often irregular, yellowish-green; rind thin; edible pulp thick orange in color; texture somewhat tender and juicy; seed small, ellipsoid; flavor very good, sweet and strongly aromatic; quality good.

Samples obtained from a tree belonging to Mr. Cipriano Pantin, barrio of Mayondon, Los Baños, Laguna, January, 1916.

Averrhoa Carambola

Baligan, Balimbing, Carambola

The carambola is one of the less important Philippine fruits. The forms met in Laguna are mostly too sour to be agreeable. There is one form, however, which is quite sweet and fairly good-sized. In La Unión Province especially good forms are said to exist.

FORM NO. 1

Fruits are very small, about 6 cm. long, 3 cm. in diameter; form oblong with five, sharp, deep, longitudinal ridges; stem small, about 3 mm. long; base slightly depressed; apex narrowed into a point; surface smooth; furrows shallow with narrow, deep line running along the middle; wings sharply angular; withering at edges when the fruit is fully ripe; color light-greenish-orange; skin very thin, translucent; seeds five to ten, about 5 mm. long, flat, oblong, and pointed; flavor too acid to be agreeable, lacks sweetness and aroma; quality very poor.

Samples obtained from Santa Cruz, Laguna, October, 1915.

FORM NO. 2

Fruits of good size, about 8 cm. long; form oblong with five deep longitudinal ridges; stem small and short; base narrowly depressed at point of stem insertion; apex usually rounded; surface smooth; wings angular, withering at edges when the fruit is fully

ripe; color greenish-yellow; skin very thin; flesh very juicy, pale yellow slightly translucent; seeds several; flavor sweet, subacid, perfectly agreeable; quality good.

Samples obtained from Maahas, Los Baños, Laguna, February, 1916.

Calamus ornatus philippinensis
Limuran, Bejuco, Rattan

This plant is one of the useful rattans. Its fruit is often brought down from the forests of Laguna. It is eaten and prized by many people and is sold at a good price in some of the town markets. The samples examined were quite toothsome, although they were somewhat too sour to be considered agreeable, and the seeds were big.

FORM NO. 1 (PLATE III, FIG. 5)

Individual fruit roundish oval, about the size and shape of a lanzon, 3.6 cm. long, 2.2 cm. in diameter; base when removed from the spikelet is pointed like the apex; calyx of 2 layers, with lobes in threes, the lobes of the outer layer being larger and broadly pointed, if not splitting as they usually do; scales which compose the shell are hard, rather brittle, smooth, pale-brownish-yellow, with dark margins, about 112 in number; the edible portion is very juicy, with some meaty substance in it; flavor sweetish, but rather too acid to be agreeable; seed large, very hard.

The fruits are borne in clusters about a foot or more in length; each cluster contains about 20 alternate spikelets which bear from 8 to 20 fruits each.

Samples were obtained from Paete, October, 1915.

Dillenia philippinensis
Catmon

The catmon is a common tree in the forests of Laguna, and seems to be widely distributed throughout Luzon. It is at present of little economic value because the people have not as yet known the important uses of its fruit. Its big, white, showy flowers are constantly produced during a large part of the year. The fruit promises to be of considerable importance for the making of jelly and marmalade. The numerous pale green carpels are beautifully spirally arranged in a ball. A fine jelly and a delicious and very attractive marmalade can be made out of these. The fleshy sepals which cover the carpels are said to be utilized in the making of curries. In the Philippines, the fruits generally go to waste.

A number of forms can be distinctly differentiated among the trees found on the lower slopes of Mt. Makiling, Laguna Province. The trees at this particular place are very abundant.

FORM NO. 1

Form roundish; axis about 4.3 cm. long, diameter 4.9 cm.; stem short, 3 cm. long, hairy and warty; base swollen, having an oval protuberance; apex rounded; sepals 5 (appearing in twos) fleshy, sub-acid; surface abundantly pubescent; color light-yellowish-green; filaments of two lengths, spare; carpels 14 to 16, arranged closely and spirally, fleshy and acid; core short, spongy; seed one or none developed in each carpel; styles long, extending half way down the height of the fruit, bright-crimson.

Leaves elliptical, with acuminate tip, 19 cm. long, 11 cm. wide, deeply serrate, dark green in color.

Samples from one tree, Mt. Makiling, low altitude, July, 1915.

FORM NO. 2

Form roundish; about 4.4 cm. long; 5 cm. in diameter; stem about 7 cm. long, hairy, base depressed at point of stem insertion; apex rounded; se-

pals five (apparently in twos), fleshy, acid and juicy; surface very hairy; color light-yellowish-green; filaments mostly short, dense; carpels 12 to 17 in number, arranged closely and spirally, fleshy and juicy, core short; seeds two or more developed in each carpel; styles short, extending about one-third down the height of the fruit, dark-crimson.

Leaves elliptical, acuminate, 19 cm. long, 11 cm. wide, entire or very slightly serrate, light-green in color.

Samples from one tree, Mt. Makiling, low altitude, July, 1915.

FORM NO. 3 (PLATE III, FIGS. 3 AND 4)

Form roundish; length about 4.8 cm., diameter 5.3 cm.; stem long, warty, not hairy; base swollen; point of stem insertion elevated; apex rounded; sepals 5, fleshy, sub-acid, juicy, whitish; surface smooth, not hairy; color light-green; filaments dense; carpels 11 or 12, neatly arranged spirally around a short narrow core, very juicy, acid; seeds, one, or two, developed in each carpel.

Leaves very similar to No. 1.

Samples from one tree, Mt. Makiling; low latitude, July, 1915.

Dillenia speciosa

Catmon Calabao; Kambong

This fruit is very similar to the catmon in form and construction. It is larger, however, and probably not so common in the Philippines as the catmon, for it has been found only on the higher slopes of Mt. Makiling. It is used in much the same way as the catmon fruit.

FORM NO. 1

Form roundish; length 5.3 cm., diameter 6.2 cm.; stem large, hairy; base narrowly depressed, deep at point of stem attachment; apex rounded; sepals variable in number, 11 to 15, appearing in threes at base, very fleshy; surface smooth, lacking hairs except a few along the edges of the sepals; color dark-green; filaments brown, long, dense around the base; carpels about 15, arranged closely and spirally, not so attached to core as in the catmon, fleshy, and juicy; seed, none developed in the samples obtained; styles 15, slender, whitish in color, extending half-way downward; core end extends over the style bases; flavor too acid to be eaten out of hand.

Leaves broad-oval, about 45 cm. long and 41 cm. wide, slightly dentate.

Samples from one tree, Mt. Makiling, high altitude, July, 1915.

FORM NO. 2

Form roundish; length 6 cm., diameter 6.7 cm.; stem big; base deeply hollowed at point of stem insertion; apex rounded; sepals appearing in threes at base, not so fleshy as in Form No. 1, about 17 in number; surface smooth, not hairy, color very pale yellowish-green; filaments brownish, dense around base; carpels 16, arranged closely and spirally around the broad core, fleshy and juicy; seeds one or none developed in each carpel; styles pale-brown, short but slender, extending downward about one-third; the top of the core reaches but about half-way to the top of the carpels instead of reaching about it as in Form No. 1. Leaves long, elliptical, about 40 cm. long, 20 cm. wide, slightly dentate; midrib fine.

Samples from one tree, Mt. Makiling, high elevation, July, 1915.

Diospyros discolor

Mabolo, Talang, Persimmon

This is a fruit that is often wasted. In some places it is not eaten by the people, and bats and other animals take advantage of it. This is not strange, however, as the mabolo is

very variable. In most places, where the better forms exist, most people like it. The main objection to this fruit is perhaps the astringent flavor and the strong odor. Cooking or making it into some kind of preserve, as they do with the native persimmons in the United States, will probably eliminate these objections.

Another objection to the fruit is the presence of big seeds in the common forms. However, there are occasional seedless forms, and one has been found which, aside from having no seed, was also the best flavored. With but little improvement, there is no reason why the best forms of mabolo should not make one of our staple varieties of fruits. The seedless fruit contains 85% of nutritious flesh; this together with its good size would undoubtedly make it a valuable fruit food. The seeds are often eaten and for this purpose immature fruits are gathered and the seeds removed.

FORM NO. 1

Form round oblate; size rather large; height about 8.4 cm., diameter 11 cm., average weight about 500 grams; base broadly and deeply depressed; stem none; calyx diameter about 24 cm.; lobes four, hairy, regular in shape, apex slightly four-cheeked, with a shallow and narrow depression at the middle; surface thickly covered with brown hairs; skin thin and not peeling off; color a dark and rich reddish purple; flesh creamy-white; texture soft yet firm, softer just around seeds; seeds kidney-shaped, 3.7 cm. long and 2.3 cm. wide, usually eight in well developed fruits; flavor is slightly astringent when ripe, strongly aromatic, lacking in sweetness; quality fair.

Samples obtained in Magdalena, September, 1915. This form seems to be one of the most common.

FORM NO. 2 (PLATE I, FIGS. 5 AND 6)

Form oblate-conical, the body being slightly square; size rather small; length about 5.6 cm., diameter, 8.5 cm.; weight about 250 grams; stem very short; base broadly depressed; calyx small, adherent, usually with four lobes; apex tipped and four-grooved; surface covered with dull-brown hairs, easily brushed off; skin rather thin and not peeling; color dark-purplish-red; flesh whitish near the center, becoming creamy toward the outside; texture soft and somewhat crisp; seedless; flavor sweet, non-astringent when fully ripe and but faintly aromatic; quality very good to excellent.

This, no doubt, is one of the very best forms. It is seedless and fairly delicious. It was relished by all who tasted the fruits.

The tree is of medium size and said to be productive. It belongs to Mr. Guillermo Mendoza, San Antonio, Los Baños, Laguna, September, 1915.

FORM NO. 3

Form roundish conical, somewhat oblate; length about 7.4 cm., diameter 8.4 cm., stem very short; base broadly depressed with a shallow cavity; calyx medium-sized, with four adherent lobes; apex rounded, slightly narrowed, with a short, distinctly protruding point; surface almost regular, rather thickly covered with dull-brown hair; skin thick, dark-purplish-red; flesh creamy-white; texture soft but rather lacking in juiciness; flavor insipid and rather astringent; seeds several, plump, kidney-shaped; quality poor.

Samples collected from a tree belonging to Mr. Silvio Lopez, San Antonio, Los Baños, Laguna, October, 1915.

FORM NO. 4

Form conical; body slightly squared; size small, ordinary fruits weighing

about 250 grams; stem short; base narrowly depressed; cavity shallow; calyx medium-sized, with four adherent lobes; apex blunt, narrowed, surface thickly covered with brown hairs; skin thin; color reddish-purple; flesh yellowish; texture soft, seeds kidney-shaped, of medium size, several in ordinary fruits; flavor good, non-astringent when fully ripe, sweet, and not very strongly odorous; quality good.

Samples obtained from a large tree in San Antonio, Los Baños, December, 1915. The tree was very fruitful last season.

Diospyros ebenaster

Sapote, Sapote negro, Persimmon

The sapote negro is much less common in the Philippines than the mabolo, and like the mabolo it is often neglected as a fruit. The soft, buttery flesh of the ripe fruit is perfectly palatable, but its dark brown, almost black, color probably prevents it from becoming more popular. In Laguna the green fruit is used for poisoning fishes.

FORM NO. 1

Form round; size small, 6 to 7 cm. in diameter; base slightly flattened; calyx with five broad, thick and leathery lobes, each having its two sides raised, forming a deep furrow along the middle; stem small, short; apex rounded; surface smooth and hard when green, when ripe, very soft and wrinkled; color dark-yellowish-green; skin thin, very tender, does not peel off; outer skin very thin, membraneous, transparent, separates easily; flesh with few fibers, very soft, dark-coffee in color; texture very fine, buttery; seed brown, oval, very hard, about 2.2 cm. long, long; four or five in number, each enclosed in a sack; lacks sweetness and aroma, non-astringent; quality poor.

Samples obtained in Manila, through Mr. L. Mendoza, November, 1915.

FORM NO. 2

Form round-oblate; size small, about 6 cm. high, and 8 cm. in diameter; stem short, small; base slightly depressed; calyx with five thick and leathery lobes, each lobe having its two sides raised, forming a deep furrow along the middle; apex rather flat to roundish; surface, when ripe, soft and wrinkled; color dark-green, shiny; skin thin and very tender, the outer skin transparent, separating easily; flesh very dark; texture very fine and buttery; fibers very sparse; seed small, brown, oval, usually eight in number, each inclosed in a sack; flavor good, aromatic, though it should be sweeter to find more favor; quality good.

Samples obtained in Manila through Mr. L. Mendoza, November, 1915.

Eugenia javanica

Macopa

Though not one of the most delicious fruits, the macopa is very attractive and is generally prized. It is often used to adorn the table and makes a refreshing, if not very nutritious, table fruit. In some forms the fruit is meaty and of large size. Some trees in Calamba have a tendency to bear fruits that are seedless and at the same time more solid and juicy than ordinary fruits.

FORM NO. 1

Form obconical; height about 4 cm., greatest diameter 4.5 cm.; stem small, inserted into a small, narrow cavity; calyx red, fleshy; lobes large, four, edges curved in; broad end (apex) flatened, having a circular depression about two cm. in diameter, partly covered by the calyx lobes; base conical with a narrow cavity at place of stem insertion; surface smooth with somewhat irregular furrows, running parallel up and down at the middle; color red, be-

coming pinkish toward the base; flesh thick, quite firm, not pithy; texture crisp, juicy; seed one, small; flavor very good, although it should be more crisp; quality very good.

This form keeps well and is commonly sold from town to town in Laguna. Samples obtained in Calamba, Laguna.

FORM NO. 2

Form somewhat irregularly oblate; height 4 cm., greatest diameter about 5 cm.; stem small; base flattened or slightly depressed; calyx small, fleshy; lobes four, small, edges turned in; apex (broad end) flattened, with a small circular depression, partly covered by the calyx; surface smooth, no special markings; color very pale yellow, with pink or red spots; flesh thin, rather spongy; flavor fair; seeds many, clinging together; quality fair.

This form is called "Macopang puti" in Calamba. Samples obtained from Mr. Martin Manrilla, who has two trees in Calamba, Laguna, May, 1915.

FORM NO. 3a (PLATE I, FIG. 3)

The following is a seedless form of fruit borne by a tree in Calamba. The same tree bears seedy fruit which is entirely different from that of the seedless form. Both kinds are borne in about equal amounts.

Form long, obconical; length 4.2 cm., greatest diameter 3.8 cm.; stem large; base conical; calyx large, fleshy, almost covering up the apical depression; apex or broad end rather flat; surface smooth; color a rich red, fading toward the base or at the side exposed to the sun; flesh thick and rather firm, juicy; seed none, or very small; flavor very good, eating and keeping qualities good.

The tree is a good bearer. It belongs to Mrs. Guillerma, Calamba, May, 1915.

FORM NO. 3b (PLATE I, FIG. 4)

Description of the seedy fruit obtained from the same tree as 3a.

Form round-oblate, slightly larger at basal end than at apical; size large; height about 3.9 cm., diameter 5.7 cm.; stem medium-sized; basal end flattened, white when exposed to the sun; apical end flattened, narrower than the basal end; calyx fleshy, medium sized; lobes 4, well formed; surface with slight depressions running up and down the side; color red; flesh rather soft and pithy; seed round, large, about two cm. in diameter; flavor and quality very good.

Lansium domesticum

Lanzon

There are two important varieties of *Lansium domesticum*. These are the duku* and the lanzon. The duku is said to be the larger and better of the two, and is one of the finest Malayan fruits. The fruit is spherical, thick-skinned, 2 to 5 in a cluster. The lanzon is ovoid to oblong-ovoid; it is evidently thinner-skinned, and there are many more fruits in a cluster than in the duku. These two fruits have a very limited distribution in the world. The duku was introduced into the Philippines last year (1915).

The lanzon is a well-known fruit in the Philippines, although it is grown in only a few places. According to Wester, it is at present grown in the eastern part of Laguna, in Misamis, Zamboanga, the Sulu Archipelago, around Argao in Cebu, around Lake Lanao in Mindanao, and in certain towns of Bulacan. The plant has a narrow range of adaptability, and the seed quickly loses its viability.

The lanzon is one of the most wholesome and appetizing fruits in the Philippines. The demand is, no doubt, far in excess of the production. The present supply from the Laguna district is almost entirely taken up by the Manila and Laguna markets. With better

* Any lanzon is called duku in Java.

methods of culture, and a more careful selection of the more excellent and productive forms, the growing of the lanzon promises to be a very profitable industry in the places where it will grow. The fruit withstands long distance transportation, and even with the present methods of rough handling and packing, it can easily reach all the more important towns of the Archipelago.

In Laguna, the lanzon industry is at present menaced by the presence of very dangerous plant parasites. At least three species of *Loranthus* work upon the trees. One of these, (*L. philippenensis*) is especially injurious to the plant, as it has been known to kill a tree in from one to two years' infestation. This parasite is well known to the people and is very common in Paete, San Pablo, and Lilio,—regions where most of the lanzon trees are found. In Paete the number of infested trees is probably not less than 80%, while in a barrio of Lilio fully 95% of the trees were infested in 1915. Considering the length of time it takes to bring trees up to bearing age, the fatality of the parasitism, and the common neglect of it, it is probable than the total number of bearing trees is decreasing instead of increasing.

The lanzon forms in the following descriptions have been differentiated upon the variability in size, flavor, and seediness of the fruit. The productivity of the trees has also been noted. The presence or absence of seed in the lanzon is particularly important, because of the exceedingly bitter taste connected with them. Anybody who has eaten a few lanzones is probably well aware of this fact. The writer has not found an absolutely seedless form, but trees have been found that have more than 90% of the fruits regularly seedless. If most of the trees were of this form, it would be perfectly easy and possible to put packages of guaranteed seedless lanzones on the market and these would easily command very high prices. By a simple observance of the correlation between the form and the presence of seed, the seedy fruits can be accurately recognized and discarded before packing.

FORM NO. 1

Form rather irregularly ellipsoid; size medium to large, length about 4.3 cm., diameter 3.3 cm., averaging almost one ounce; seed always present, one to four, variable in size; bunches generally short, loosely set; base rounded; apex rounded, with a dark, small point; calyx weakly attached to the stem; sepals five, light-grayish-yellow, regularly placed; peduncle short, slender, light-greenish-brown; surface tomentose, slightly furfowed longitudinally; color dull-yellow, becoming slightly reddish at both ends; skin thin, peeling off easily; flesh whitish, translucent, juicy; cell-coats thin, the greater part separating easily; flavor sweet, very faintly acid; quality poor.

The tree has spreading branches, which is very uncommon in lanzon trees. It is owned by Mr. Francisco Buenaseda, Ibabang Sungi, Lilio, Laguna. Sample obtained in September, 1915. Yield less than 1 *kaing*.

Distinguishing characters: large size, seediness, spreading habit of the tree.

FORM NO. 2

Form roundish to ellipsoid; size very variable, very small to medium; the medium-sized fruits are always seedy; bunches usually very short and poorly set with fruits; base rounded; apex rounded; calyx somewhat broad; peduncle very short and slender; surface slightly furrowed longitudinally; color dull-yellow, reddening slightly at both ends; skin rather thick; flesh whitish, translucent; cell coats thin; flavor poor, insipid or too acid; quality very poor.

The tree belongs to Mr. M. Noble, Lilio, and is cared for by Mr. V. B. Buenaseda, Ibabang Sungi, Lilio, Laguna. Yield poor.

Distinguishing characters of this form: fruits small in size, poor in flavor and quality.

FORM NO. 3

Form usually obovate; size quite uniformly medium; fruits usually seeded; bunches very closely set, often 20 to 40; basal portion usually conical and rather quadrangular; base narrow; apex rounded with a small, dark-brown point; calyx light-grayish-brown, sepals irregularly outlined; peduncle stout, medium-long, dull-brown, well fruited; surface tomentose, slightly furrowed longitudingly; color dull-yellow, skin rather thick, and difficult to peel off; flesh whitish, translucent, juicy; cell coats well developed and thick; flavor sweet, subacid; quality good.

Distinguishing characters: close bunching of fruits, the obovate or obconical form.

The tree belongs to Mr. M. Noble, barrio Uplis, Lilio, Laguna, September, 1915. Yielded about one *kaing* in 1915, said to have yielded three *kaings* in 1914.

FORM NO. 4 (PLATE I, FIGS. 9 AND 10)

Form almost regularly obovoid; size medium to small; seeds very rarely developed; bunches rather small but closely set; base roundish; apex rounded, with a small dark point; calyx rather narrowly attached; sepals dark and somewhat irregular in outline; peduncle generally short; dark-greenish-brown; surface tomentose, slightly furrowed longitudinally; color dull-yellow; skin thin, peeling off easily; flesh whitish, translucent, juicy; cell coats thin; flavor, sweet, subacid, delicious; quality excellent.

The tree from which the fruits were obtained belongs to Mr. Noble, Uplis barrio, Lilio, Laguna. More than 90% of the fruits gathered had only undeveloped seeds. Two other trees in the same grove bear the same good quality of fruits, mostly seedless. These trees averaged about a *kaing* in the 1915 season. This yield may be considered a good yield for that year and in that region. In the San Pablo and the Paete regions, the individual yields are said to run much higher. However, judging from my observation of the trees on this point, the average yield per tree in 1915 in any of these regions was probably much less than a *kaing*, for a large number of the trees were absolutely barren.

FORM NO. 5

Form ellipsoid; size very variable, small to large, mostly medium; very often seedy, containing one to three seeds; bunches generally long, loosely set; base rounded, often narrowed; apex roundish to round; stigmatic point prominent; calyx rather narrow; sepals dull brown; peduncle generally long and strong, light-greenish-brown; surface tomentose; color dull-yellow; skin medium-thick; cell coats thin; flavor sweet, subacid; quality good. Fruits ripening quite uniformly.

This form is perhaps the most common. The tree from which the samples described were obtained belongs to Mr. Esteban Villarin, Paete, Laguna. It yielded five *kaings* in 1915 and was the most productive tree fround by the writer in that year.

FORM NO. 6

Form ellipsoid to ovoid; size medium to large; length about 4.2 cm., long diameter about 3.3 cm.; bunches generally long, loosely set; base rounded; apex roundish with a small, dark stigmatic point; calyx broad; sepals greenish-gray, regularly formed; peduncle slender, greenish-brown; surface tomentose.

slightly furrowed longitudinally; color dull-yellow, reddening slightly at both ends; skin thin, peeling off easily; flesh whitish, translucent, juicy; cell coats thin, the greater part separating with the skin; flavor sweet, sub-acid, agreeable; quality fair.

The tree from which the samples described were obtained is said to bear twice a year regularly, and I have seen the second season flowers with the mature crop on the tree at the same time. It belongs to Mr. Santiago de la Peña, Barrio Ibabang Sungi, Lilio, September, 1915.

Lucuma mammosa; Acharadelpha mammosa (L.) Cook.

Chico mamey; Sapote colorado

Another tree of very limited distribution in the Philippines is the chico mamey. The writer knows that, at present, it is grown only in two or three towns in Laguna, and has been told that it is found in Alfonso, Cavite, and in one or two towns in Bataan. Even in Pakil, where most of these trees in Laguna are located, there are very few. It is rather strange that the chico mamey is not more widely grown in the Philippines since there seems to be no particular reason which prevents its wider culture.

The fruit, which ranks with the chico and the mango in eating qualities, has a greater size than either of these fruits. In Laguna, the fruit rarely gets out of the towns where it is produced, and is sold locally at about 10 centavos apiece. It is grown from seed and becomes a tree. It is said that it bears fruit at the sixth or seventh year. In the American tropics it varies very widely and many very superior forms exist there. It seems certain that the early introductions into the Philippines did not include any of these finer forms.

FORM NO. 1

Form ovoid; size medium; length about 14 to 15 cm., diameter 8.5 to 9.5 cm., weight about 700 grams; base flattened, with a round, woody protrusion at the middle; sessile; calyx not persistent; apex conical; surface very rough; color dull-brown; skin thick and rather hard, cracked at the outer part, and sparsely lined, longitudinally, with long, yellow fibers at the inner; flesh reddish-brown; texture tender, juicy; central core rather thick, light ochre, fibrous along one side of the seed; seed one, long-ellipsoid; flavor sweet, agreeably aromatic, delicious; quality very good.

The fruits described were of the second season. There were about 20 on the tree, which was under the care of Mr. Pedro Dalina, Pakil, Laguna; October, 1915. The tree was in profuse bloom for the real season, April and May.

Mangifera indica

Manga, Mango

With the exception of the banana, the mango is undoubtedly the most important commercial fruit in the Philippines. Not only is it universally esteemed for its delicious flavor, but as an export fruit it is very promising; in favorable years some export shipments have already been made. The ripe fruit is generally eaten fresh, but sometimes it is preserved whole in syrup or molasses, or sometimes it is made into sherbets. The green fruit is widely used as a condiment and for cooking and is served thus in a variety of ways.

The mango thrives well in all parts of the Archipelago, in spite of the very general neglect of it. It is rarely grown in regular orchard form, but it is widely planted and is usually found in a semi-wild condition along the borders of rice fields, on hilly lands, about houses, etc.

The trees at present in bearing are all seedlings, which according to Wester, explains for the most part the barrenness of a large percentage of the trees. Thus, a census taken in the summer of 1911 in a mango orchard that had suffered but little from insect attacks, showed only 23% of the trees yielding a satisfactory return. Aside from this as a cause of low yields, insect attacks, especially on the flowers, and rains at flowering time, are, no doubt, important factors also.

It is well known that the choicest varieties of mangos, in the Philippines, reproduce themselves remarkably well from seed, yet slight individual seedling or bud variation can perhaps be better controlled by vegetative propagation. Now that the propagation of the mango by asexual means has been greatly improved by the simple but successful method of budding, instead of the old-time and difficult process of inarching, the seedling method will probably be discarded. Moreover, mango trees propagated vegetatively fruit in about one-half the time of seedling trees; they are dwarfed, a condition which allows an easier protection of trees and fruits from diseases and insect pests, and affords greater convenience in picking the fruits and a better control of the productivity of the trees by bud selection.

One peculiar practice in connection with mango growing in some localities is that of smoking the trees. This is done to hasten the production of fruits or to force the trees to bear fruits out of the regular season. Smudges are built under the trees about September, and this treatment is kept up regularly for about a month, when the trees may send forth blossoms. Some of the trees certainly yield to this treatment. One probable effect of smoking is undoubtedly that of driving insects away from the trees. The great desirability of producing fruit out of season is evident, and in the planting of orchards, the selection of forms having a tendency to off-season fruiting should be considered.

Wester's method of describing mango types has been followed in the following descriptions.

FORM NO. 1

Carabao alulongue

This is one of the so-called Carabao mangos. Fruit small, about 9.6 cm. long, 6.3 cm. wide and 5.7 cm. thick, weighing about 192 grams; form oblong, slender asymmetrical with full cheeks; ventral shoulders slightly more prominent than the dorsal; stem inserted almost squarely; base markedly depressed; beak distinct, not coinciding with apex; nak about 10 to 20 mm. above the apex, somewhat prominent; surface very smooth; lenticels small, numerous; skin medium-thin, tough; flesh yellow, tender, juicy; flavor sweet and aromatic; quality very good; fiber, medium-coarse, abundant, short except at ventral edge of seed; seed oblong, medium-large.

Remarks: The tree from which the samples were gotten was about 9.5 meters high, about 65 years old, not vigorous. It was said to be early fruiting and to yield fruit off-season in November and December under the stimulation of fumigation. At this season, however, very few fruits are produced, only from 50 to 100. This tree is owned by Mr. Matias Nepumoceno of Malabon, Cavite.

FORM NO. 2

Carabao

This seems to be the most common of the so-called Carabao mangos. The fruit is medium-sized, being about 11 cm. long 7.5 wide, 6.4 cm. thick, and weighing about 286 grams; form oblong, asymmetrical with full cheeks; ventral shoulder generally much more prominent than the dorsal; stem inserted obliquely;

base rounded, with a furrow usually leading from the stem base to the middle of the back; beak rather indistinct but not coinciding with apex; nak about 1.5-2.5 cm. above apex, usually not prominent; surface very smooth; lenticels large, numerous, light-yellow, more sparse at basal than at apical portion; skin medium-thin, tough; flesh pale-yellow, very tender and melting; flavor very delicate, sweet, and aromatic; fiber medium-coarse, abundant, short except at ventral edge of the seed; seed oblong, medium-large; quality excellent.

The tree from which the samples were obtained was about 12 meters high, about 90 years old, vigorous. It yielded heavily at the time of my visit and its fruits may be said to be of the most excellent so far as eating quality is concerned; the keeping and shipping qualities, however, are doubtful. The tree is found about four miles from Malabon, Cavite, on the road (right side) to Santa Cruz, and was under the care of Mr. Mariano Tagle.

A good-sized tree of this variety, found in the groves of Mr. Zacarias Leaño of Malabon, Cavite, was the most fruitful mango tree observed in 1915. It gave about 3,000 fruits, for which the fruit dealers have paid more than 70 pesos. This must have been an extraordinary yielder for that year, although much bigger yields have been known in other years. The mango crop of 1915 was conspicuously poor.

Form no. 3

Calabao Mulatto

This is one of the common carabao varieties, called "Mulatto" because of its big size. The average fruits were 11.9 cm. long, 7.9 cm. wide, 7 cm. thick, and weighed about 325 grams. The outlines of the fruit when seen broadwise and frontwise are oval, with very full cheeks; ventral shoulder more prominent than the dorsal; stem insertion square or oblique; base rounded, sometimes narrowed; beak indistinct, generally coinciding with apex; nak about 1.5-2.5 cm. above apex, not prominent; surface rather coarse; color yellowish, tinged with green; lenticels large, pale-yellow, more numerous around apex than around base; skin thick but not tough; flesh yellow, very tender and juicy; flavor very good, aromatic but not so sweet as the smaller carabaos; fibers medium-coarse, rather long, especially along the ventral edge of seed where it is very long; seed small in proportion, thin and wide; quality very good.

The tree from which the fruits were described was said to have produced over a thousand fruits in the regular season, 1915, while about 50 fruits were gathered during the November preceding. The tree was calculated to be about 13 meters high and 70 years old. It was vigorous, although a lichen was very abundant on its branches. The tree was found in barrio Tapia, Malabon, Cavite, owned by Mr. Doroteo Lucero.

Form no. 4

Cabayo (Horse) Mango

This mango may be said to be intermediate between the carabao and the pico, as it partakes of the character of both of these mangos. Its plumpness and the slope of the back are characters which belong to the carabao, while the qualities of the skin and the flesh closely resemble those of the pico.

The fruit is long but full-cheeked, measuring about 12.3 cm. long, 6.4 cm. wide and 6.3 cm. thick, and weighs about 246 grams; form oblong, asymmetrical, with full checks, usually as thick as wide; ventral shoulder slightly prominent; dorsal shoulder sloping down abruptly; stem inserted somewhat ob-

liquely; base rounded, often with a wide furrow running ventrally from stem base to beak; beak not sharp, coincident with apex; nak 15 to 25 mm. above apex, variable in size; surface smooth; color yellowish, splashed with green between the basal and apical ends; lenticels inconspicuous, very sparse, especially on the upper half; skin medium-thick, not tough; flesh orange, tender; flavor good, aromatic; fiber coarse, very abundant, long, especially along ventral edge of seed; seed long, oblong, medium-large.

The tree from which the samples were gotten was fairly large, about 11 m. high, with a round, oblong crown; age from 40 to 50 years. The tree bears a close resemblance to a pico tree; the leaves are small, regularly elliptical, as pale as the picos but as thick as the carabaos. This tree was said to give a fair yield, about 1500 fruits in the regular season and about 100 in the off season. It was found in the barrio Vacante, Malabon, Cavite and is owned by Mr. Mariano Guarin.

FORM NO 5

Chupadera, Pahutan

This mango is the pahutan or Chupadera mango. Its latter name has arisen from the fact that this fruit is more conveniently eaten by sucking the juicy fibrous flesh than by cutting it and eating it with a spoon, the manner in which the mango is usually eaten.

The fruit is small, about 8.5 cm. long, 5 cm. wide and 4.6 cm. thick, and weighs about 73 grams; form oblong to oval, asymmetrical; ventral shoulder slightly more prominent than the dorsal; stem inserted obliquely; dorsal shoulder sloping down gradually; base roundish; beak distinct, coinciding with apex; nak about 1-1.5 cm. above the apex, not prominent; lenticels small, numerous toward the apical portion, pale yellow; skin moderately thick, very tough and with numerous fibers adhering on the inner side; flesh reddish-orange, tender and very juicy; flavor very sweet and delicately aromatic; fibers medium-coarse, profuse; seed very large in proportion, oblong, with several deep furrows running singly and longitudinally.

The tree from which the samples were obtained was large and vigorous and bore numerous fruits, many of which grew in bunches, a distinguishing character, it is said, of this kind of mango. The particular tree from which the samples came belongs to Mr. Marcelo A. Lucero. It is in barrio Pasong Calabao, Malabon, Cavite.

FORM NO. 6

Corazon (Heart) Mango

This mango was perhaps introduced into the Islands as a distinct variety. In Malabon I have found one person owning five trees of this variety. This mango is of the highest quality, more delicious, perhaps, than any other mango in the Philippines.

The fruits obtained were small, measuring on the average 8.4 cm. long, 5.7 cm. wide and 4.8 cm. thick, and weighing about 125 grams each; the fruit is roughly heart-shaped with full cheeks; ventral shoulder more prominent than the dorsal; stem inserted obliquely; base rounded; beak almost invariably a sharp point, coinciding with the apex, placed on the dorsal, instead of on the ventral part; nak about 1-1.5 cm. above apex, fairly prominent; surface smooth; color yellow; lenticels pale-yellow, numerous and well scattered all over the body; skin medium-thin, tough and with pronounced brownish veins; flesh yellow, paler than that of the carabao, very tender and juicy; flavor very sweet with a peculiarly agreeable aroma; fiber coarse, short except along ventral edge of seed; seed oblong, medium-large.

The tree from which the samples were obtained was owned by Mr. Gregorio Varrientos in barrio Tapia, Malabon, Cavite. It was said to be the most productive, bearing about 3,000 fruits during the regular season, besides about one hundred during off seasons, when fumigated. The tree is about 80-100 years old and has rather smaller and narrower leaves than other varieties. It is vigorous.

FORM NO. 7

Bulak (cotton) Mango

This mango resembles the Pico very much. The name of this mango probably refers to the whitish color of the flesh of the green fruit.

Average size of the fruit, 11.2 cm. long, 6.1 cm. wide, and 5 cm. thick, weight about 175 grams; form long-oblong, asymmetrical, flattened; ventral shoulder slightly more prominent than the dorsal; dorsal shoulder sloping abruptly down; stem inserted squarely or obliquely; base roundish; beak distinct, not usually coinciding with apex; nak 1 to 1.5 cm. above apex, prominent; surface smooth; color distinctly orange, lenticels light-orange; sparse at basal but abundant on the apical portion of the fruit; skin thick and tough; flesh orange, tender and somewhat coarse; flavor good, aromatic; fiber medium-coarse, short except along the ventral edge of the seed; seed long-oblong, small.

The tree from which the samples were described was medium-sized and about 60 years old. It was owned by Mr. Gregorio Varrientos, in barrio Tapia, Malabon, Cavite.

FORM NO. 8

Anis Mango

This is a small mango and resembles closely in color and flavor the Corazon, though not so juicy, and different in shape. It is 8.1 cm. long, 5.3 cm. wide, 4.6 cm. thick, and weighs about 105 grams; the form often resembles that of the Pico, but it is much smaller; ventral shoulder usually prominent; dorsal shoulder sloping down gradually, stem inserted rather obliquely; base rounded; beak distinct, not coinciding with apex; nak 0.5 to 1 cm. above apex, prominent, almost coinciding with beak; surface smooth; color yellowish; lenticels few, light-yellow; skin medium-thick, tough, netted with conspicuous brown veins; flesh yellow, paler than that of the Carabao, very tender and juicy, but not so much so as the Corazon; flavor very sweet, delicate, with a distinct aroma similar to that of the Corazon; fiber medium-coarse to fine, short, not abundant along the edge of seed where it is long; seed comparatively large, oblong.

The tree from which the samples were gotten was of medium size and vigorous; it belonged to Mrs. E. Columna, barrio Pasong Cawayan on the road from Malabon to Buenavista.

FORM NO. 9

This was called Saheng mango by some in Malabon, but it is evidently not the real Saheng.

The fruit is on the average about 8 to 9 cm. long, 6.3 cm. wide, 5.1 cm. thick, and weighs about 200 grams; form oblong, asymmetrical, flattened; ventral shoulder more prominent than the dorsal; stem inserted rather obliquely; basal end flattened; beak rather indistinct, between apex and nak; nak about 1-1.5 cm. above apex, big and quite prominent; surface rather rough; color greenish-yellow, markedly reddened where exposed to sunshine when green, the fruit presents a purplish skin; lenticels yellow, sparse on the dorsal but very numerous on the ventral portion; skin thick, rather tough; inner side of

skin reddish-orange; flesh orange, tender, not juicy; flavor rather sweet but lacking aroma; quality poor.

Only one tree of this form has been found. It was large, about 13 m. tall, with a round, vigorous crown, but very unproductive. In the twenty years that Mr. Pedro Nacon tended it, it fruited only three times and never gave a heavy yield. It is found along the road to Buenavista in barrio Mangan Bucol.

FORM NO. 10

Pico

This is a representative variety of the Pico Mango, a few trees of which are found at the College of Agriculture.

Form oblong, asymmetrical, tapering abruptly from the middle toward the beak; size medium, averaging about 11.3 cm. long, 7.2 cm. wide, 5.7 cm. thick, and weighing about 240 grams; ventral shoulder very prominent, dorsal shoulder sloping down gradually; stem inserted obliquely; base rounded; beak distinct, not coinciding with apex; nak 1.5 to 2.5 cm. above apex, prominent; surface smooth; color yellowish-orange, with greenish blotches on checks; lenticels pale-yellow, not abundant, more sparse on basal than on apical portion; flesh orange, tender, not so juicy as that of the Carabao; flavor very good, sweet and aromatic; fiber fine, abundant, and short except along the ventral edge of the seed; seed medium-large, long and oblong; the fruit has apparently good keeping qualities.

The tree from which the samples were obtained did not, in 1915, give even a fair crop, although it flowered very profusely in February and again in April. During the first period, the flowers were almost totally destroyed by insects, while during the second, the flowers seem to have been totally destroyed by rain and insects together. I have no doubt that this tree would be very productive were it given proper care—cultivated, guarded from insect attacks and not allowed to suffer drought. In 1914 it yielded rather heavily.

Psidium Guajava

Guava

The Guava is another plant of very wide distribution in the Philippines. The bush is generally found on waste lands, where it pushes its way above the cogon, and other grasses. The ripe fruit of the better forms is for the most part crisp, juicy and delicious just after gathering, but quickly loses some of these fine qualities, hence the insipidity of marketed or long-kept guavas. The fruit is extensively made into jelly, for which it is noted. Other preparations are also made from it.

The guava is very variable. There are probably hundreds of forms existing. Some of these are excellent. Most of those growing spontaneously are very poor, some being scarcely edible. In general, the forms may be grouped into the white and the red-fleshed forms. The white-fleshed forms, are, as a rule, smaller, more crisp, and have a better flavor than the red-fleshed.

Dark-Colored Forms

FORM NO. 1

Fruits of rather large size, weighing up to 90 grams; form obovate; length about 5.8 cm., diameter 5.4 cm.; stem of medium size and length; base tapering, point of stem attachment slightly depressed; apex rounded; calyx lobes small; basin small, sunken; surface smooth; ridges not prominent, except basal portion; color dull-greenish-yellow, rind thick, deep-pink, coarse-textured; pulp deep-pink, fleshy; flavor excellent when fully ripe; seeds large, hard, comparatively few; quality excellent.

College grounds, July, 1915.

FORM NO. 2 (PLATE I, FIGS. 7 AND 8)

Fruits medium to rather large in size; length 4 to 6.4 cm.; diameter 4 to 4.8 cm., form elongated-ellipsoid to obovoid; stem stout, short to very short; base usually tapered; apex rounded; calyx base fleshy; lobes wide and long; basin slightly sunken; surface wrinkled, color dark-greenish; rind dark-pink, medium-thick, fine-textured; pulp dark-pink, tender and fine in texture; flavor sweet and aromatic; seeds small, comparatively few and hard; quality very good.

College grounds, September, 1915.

FORM NO. 3

Fruits large; form oblate to obovoid; stem short and stout; base narrow and flattened; apex broad and rather flat; calyx diameter large to very large; lobes small; basin broad and sunken; surface smooth, with uneven ridges or prominences; color greenish-yellow; rind coarse, thick and pink-colored; pulp pink, fleshy and rather firm; flavor subacid; seeds medium-sized, numerous, easily crushed; quality good.

College grounds, September, 1915.

FORM NO. 4

Fruits small to medium-sized; form round to roundish-oblate; stem short and stout; base rounded, depressed at point of stem insertion; calyx large; apex rounded or slightly flattened; surface smooth, with inconspicuous ridges on basal portion only; color greenish-yellow; rind medium-thick, rather coarse, red in color; pulp crisp, deep-red in color; seeds few, large and hard; flavor and quality poor.

The leaves of this guava are comparatively very large. Fruits collected at Uubi barrio, Majayjay, Laguna, August, 1915.

FORM NO. 5

Size medium to large; length about 4.2 cm., diameter 3.8 cm.; form oblong-oval; stem very long and slender; base rounded, depressed at point of stem insertion; apex rounded; calyx many-parted; basin rather small, slightly sunken or not; surface smooth, with few, not prominent ridges; color yellowish-green, with green, somewhat conspicuous lenticels; rind medium-thick, pinkish toward the inner portion; pulp pink, crisp and fine-textured; flavor rather insipid and non-aromatic; seeds numerous, medium-sized, hard; quality fair.

College grounds, July, 1915.

FORM NO. 6

Fruits of small size, about 3.4 cm. by 3.6 cm., form obovate; stem long and large; base noticeably tapered; calyx small, lobes very dry; apex rounded; surface smooth; ridges and furrows merely traces, except around the base; color greenish-yellow; rind very thin; yellowish in the outer half of its thickness and pink in the inner; pulp bright-pink, mostly gelatinous; flavor lacks sweetness and aroma; seeds medium-sized, hard, very numerous; quality poor. Fruits borne singly.

College vicinity, south of banana plantation, beyond the creek, June, 1915.

FORM NO. 7

Fruits of small size, length 4.6 cm., diameter about 4.0 cm. form ovate; stem long and slender; base tapered; calyx large, with five broad, spreading lobes; apex rounded; surface smooth; ridges and furrows absent, or traces only; color yellowish-green; rind medium-thick, tender, of a rich, deep-pink color, except very near the surface; pulp very tender, juicy, of same color as the rind; seed small, comparatively few; flavor very sweet and aromatic; quality excellent. Fruits borne singly.

College grounds, south of citrus grove. June 1915.

FORM NO. 8

Fruits small to medium in size; diameter 3.8 to 5.3 cm., length 4.3 to 5.5 cm.; form obovate; stem long and slender, inserted in a depression at base; base tapered; apex rounded; calyx small; basin rather deeply sunk; surface smooth but not plain; ridges and furrows large but indistinct, except on basal portion; lenticels conspicuous, though sparse, brownish; color dull, greenish-yellow; rind medium-thick, pink, tender and crisp; pulp pink, fleshy; seeds numerous, large, hard; flavor delicious, aromatic; quality very good to excellent.

College grounds, July, 1915.

FORM NO. 9

Fruits medium-sized to small; form pyriform, stem medium-sized, very short; apex rounded; base very narrow, with a polygonal cross-section; calyx very small, with thin lobes; calyx basin green; surface smooth; ridges several, not prominent except at base; color green or dark-green, even when ripe; rind thin, pink, very tender, fine-textured; pulp rich-pink, very tender and melting; seeds numerous, small, hard; flavor insipid, lacks aroma; quality poor.

College grounds, July, 1915.

FORM NO. 10

Fruits of rather small size, about four cm. in diameter; form usually roundish-oblate, very regular; stem stout and short; base usually flattened; calyx medium-sized; basin slightly sunken; surface smooth; furrows none, or sometimes two or more very shallow ones; rind rather thin, greenish or yellowish near the surface, becoming pink inward, rather coarse-textured; pulp pink, tender; seeds hard, medium-sized and numerous; flavor sweet and sparingly aromatic; quality very good.

College grounds, July, 1915.

FORM NO. 11

Fruits of very small size, round, about 2.7 cm. in diameter; stem of medium size, long; base rounded; calyx medium-sized, basin slightly depressed, lobes usually not persisting; apex rounded; surface smooth, with four or five distinct, evenly spaced furrows, which become ridges around the base; color an attractive yellow; rind thin, maize-yellow near the surface, but becoming pinkish toward the inner portion; pulp pink, fleshy, rather firm; flavor delicious, aromatic; seeds small, comparatively few and easily crushed; quality very good.

College grounds, June, 1915.

FORM NO. 12

Fruits of medium size, about 6x5 cm.; weight about 70-75 grams; form obovate; calyx small; base narrowed; apex rounded; surface rather rough, with prominent ridges running up and down; color orange-yellow; flesh pink except the outer margin of the rind, where it is orange; texture rather fine; seeds small, comparatively few; flavor rather lacking in sweetness and aroma, but eating and keeping qualities good.

This is a common commercial form of guava in Laguna. Samples obtained at Calamba market, May 1, 1915.

FORM NO. 13

Fruits of rather small size; diameter about 4 cm.; form round-oblate to round, very regular; stem big, short; base rounded, slightly depressed at point of stem attachment; calyx of large diameter, lobes large; apex round or slightly flattened; surface smooth, no ridges and furrows, except sometimes two very shallow furrows; rind medium-thick, greenish near the surface, pale-reddish-orange inward, rather coarse-textured; pulp pale-reddish-orange, tender; seeds large, hard but comparatively few; flavor aromatic but lacking sweetness; quality good.

The tree is prolific and its fruits are often clustered, many on a twig. College Grounds, south of Silk house, June, 1915.

FORM NO. 14

Fruit rather large; length about 5.8 cm., diameter 5.2 cm., weight about 75 grams; form obovate; stem short and stout; basal portion asymmetrical; base slightly pointing toward one side of the fruit; point of stem attachment slightly depressed; apex rounded; calyx small, basin on the level of the outline, lobes four or more of medium size; style persisting; surface rather rough; ridges few, not prominent, besides the four peculiar ridges characteristic of this form; two pairs of sharp ridges, with thin outgrowths, originate from two opposite points at the base of the fruit; these lines may be related to the angles of a young guava stem. Color of the surface yellowish-green; rind thick, coarse, pinkish and firm; pulp fleshy, pinkish; flavor sweetish, subacid, with a pronounced but not the most agreeable aroma; seeds few, big, very hard; quality very good, being fleshy, and of good size.

College Grounds, July, 1915.

FORM NO. 15

Fruits of good size; diameter about 5.3 cm., axis 4.4 cm.; form roundish to round-oblate; stem short and stout; base depressed at the point of stem attachment; calyx very small, diameter 0.6 cm.; apex generally flattened but not depressed; surface smooth, ribbed; ridges variable in development, when prominent the furrows become conspicuous along their middle lines; color dull-green, paler on the exposed sides; rind thick, tender, rather coarse-textured greenish in color to one-third of its thickness, becoming pinkish in the remainder; pulp soft yet firm, of a violet tint, paler than the pinkish rind; seeds small, thick, hard and numerous; flavor sweetish, subacid, aromatic, eating and keeping qualities good. Fruits borne singly.

The tree attains a good height for a guava tree and has a single, strong trunk. It is fruitful and seems to be of a hardy nature. It promises to be a good commercial guava. College of Agriculture grounds. South of the citrus grove. June, 1915.

FORM NO. 16

Fruit medium-sized, about 4 cm. in diameter and 4 cm. long; form ovate; stem medium-long and slender; base slightly flattened; calyx elevated, small, with the lobes usually dropping off, leaving a cup above the apical outline; apex slightly narrowed; surface smooth, with several clean, straight furrows, not evenly spaced; color pale-greenish-yellow; rind cream-white, very thin, fine-textured; pulp pinkish-cream, with much of the gelatinous substance around the seeds; seeds small, numerous, easily crushed; flavor sweetish, aromatic; quality fair.

College grounds, June, 1915.

FORM NO. 17

Fruit small to medium in size, about 4 cm. long, and 3.5 cm. in diameter; form obovate; stem of medium size and length; base pointed, with several ridges radiating from it; calyx medium-sized; lobes large, mostly not persistent; calyx basin slightly sunken; apex rather flattened; surface smooth, with indistinct ridges and furrows, except at base; color greenish-yellow; rind cream-colored, thick, coarse-textured; pulp pale-orange, tender; flavor sweet, aromatic; quality good. College grounds, June, 1915.

FORM NO. 18

Size small to medium; length about 4 cm., diameter 4.4 cm.; form round to round-oblate; stem medium-sized, slender; base broadly depressed; apex rounded; calyx lobes four, large; basin

rather large, sunken; surface smooth; ridges narrow, noticeable only on basal portion; color light-greenish-yellow, rind rather thin but crisp and juicy; pale-orange incolor; pulp buttery in texture and pinkish in color; seeds large, many, very hard; flavor very good; quality poor on account of its small size and very hard seeds.

College grounds, August, 1915.

FORM NO. 19

Fruit rather large, length about 5.7 cm., diameter 6 cm., weight about 80 grams; form turbinate; apex slightly flattened; calyx lobes breaking off easily; basin sunken; base abruptly tapered, and curved to one side; surface smooth, ridges inconspicuous except around the base; color yellowish-green to yellow; rind thick, pale-cream-colored, rather coarse in texture; pulp pale-creamy-white, tender; flavor not very sweet, aromatic; seeds large, and hard but comparatively few; quality very good.

Magdalena market, Laguna, August, 1915.

FORM NO. 20

Size large; form obovate; stem of medium size and length; base usually gradually narrowed; apex rounded; calyx lobes small; cavity small, depressed; surface rather rough, ridges prominent with round protuberances at the end of each at the base; color dull-greenish-yellow; rind thick, rather coarse, pale-orange in color; pulp creamy-white, soft; seed large, hard, comparatively few; flavor and quality excellent.

College grounds, July, 1915.

FORM NO. 21

Fruit attaining large size, often weighing more than 80 grams; form round to round-oblate; stem short and stout; base depressed at point of stem insertion; calyx small; apex rounded or slightly flattened; surface somewhat ribbed; ridges variable in prominence; color dull-green; rind thick, tender, rather coarse in texture, pinkish in color; pulp tender; seeds numerous, small and hard; flavor sweet and very aromatic; quality very good.

This is one of the best-fruiting forms. Samples obtained from a tree in the College Grounds, July, 1915.

FORM NO. 22

Fruit of small size; length about 4.5 cm., diameter 2.2 cm.; form ovate; stem medium, short; base rounded; calyx large, basin sunken, lobes small; apex noticeably tapered; surface rather rough, though glossy, with very regular, straight, deep furrows, four in number; color yellowish-green; rind medium-thick, greenish and somewhat rough-textured; pulp cream-colored, of fine texture; flavor fair; seeds numerous, large, easily crushed; quality poor, but the fruit has a very good appearance.

College grounds, June, 1915.

FORM NO. 23

Form round-oblate; size very small, 3.7 cm. by 3.4 cm., weight about 26 grams; stem large; base somewhat depressed; calyx of wide diameter, lobes large; apex usually flattened; surface smooth, with several rather prominent ridges on apical portion; color greenish-yellow; flesh rather firm, creamy-buff; rind thick; texture coarse; seeds many; flavor sweet, very aromatic; quality very good.

Samples described were from a tree owned by Mr. Gabriel Salgado, Pasong Cauayan, Malabon, Cavite. June, 1915.

FORM NO. 24

Form round, or slightly oblong; size small, about 4x4.2 cm., weight about 38.5 grams; stem small; calyx narrow; lobes small; base and apex rounded; surface smooth, with several non-prominent ridges around base and apex;

color citron-yellow; flesh firm, whitish; rind rather thick, very pale cream; texture fine and crisp; seeds comparatively few; flavor sweet and aromatic; quality very good; keeps well.

Fruits described were obtained from a tree owned by Mr. Gabriel Salgado, Pasong Çauayan, Malabon, Cavite, June, 1915.

FORM NO. 25

Fruit rather small, about 3.9 cm. by 3.4 cm., roundish; stem short; base invariably depressed; calyx of medium diameter, lobes large; apex rounded; surface smooth, plain; color pale, dull-green when ripe; rind whitish, tender, medium-thick, rather coarse-textured; pulp whitish, somewhat spongy and dry; flavor sweet, but lacking aroma; seeds many, small, easily crushed; quality good.

College grounds, July, 1915.

FORM NO. 26

Fruit of small size; diameter about 3.6 cm., weight about 32 grams; form round; stem small; calyx large, prominent, with the sepals rolled; base and apex rounded; surface smooth, with five to seven regular furrows running from base to apex; color pale-citron-yellow; flesh whitish, soft; rind medium-thin, yellowish; texture fine and crisp; seeds many; flavor aromatic, sweet, quality good; keeping quality poor.

Samples described were obtained from a tree owned by Mr. Gabriel Salgado, Pasong Cauayan, Malabon, Cavite, June, 1915.

Two other forms of guava that are very peculiar have been met with. The fruits of both have unfortunately been seen only in their green stage. However, both of them are peculiarly distinct forms and can be distinguished as such even at this stage. The green fruits of one of these forms are very sour and unpleasant in taste. I have compared this taste with that of the green fruits of other guavas and none approached it in sourness. The tree that bears such peculiar fruits is the one near the southwestern corner of the Academic Building, College of Agriculture. The maturing fruits and the greater part of this tree were destroyed by the baguios of 1915.

The other form has very small fruits, ellipsoid in form, medium-sized stem, with small calyx. The surface of the green fruit is smooth, with narrow, straight, longitudinal furrows, and with longitudinal, conspicuous whitish stripes, as many as the furrows. The leaves are small, narrowly elliptical, and also with whitish markings. This form is perhaps of interest only as an ornamental plant. The tree was very small and was found in a field near the College grounds.

Sandoricum Koetjape (*Burm.*) *Merr.*

Santol

The santol is at present one of the least esteemed fruits in the Philippines. With some improvements, however, it might be one of the most promising. The main objection to the santol is that most of the fruits are very sour and the seeds too large in proportion to flesh. Trees can be found that bear fruits of excellent flavor, but so far none has been found that bear fruits containing small or no seeds. The excellently flavored fruits are highly prized and command high prices. The inferior ones may be candied.

FORM NO. 1

Fruit roundish-oblate; weight 105 grams; length about 5.1 cm.; diameter 6.2 cm.; stem medium-sized; base roundish; apex slightly flattened; surface rough, velvety, with narrow ridges at base; color antimony-yellow; rind medium-thick, cream-white, slowly turn-

ing to brown on exposure to air; texture fine, rather tough; flesh around seed very juicy, fibrous, sweetish, subacid; flavor of rind too acid to be agreeable; seeds large, four or five developed; quality poor.

The tree is large, very vigorous, and bore a heavy load of fruits in clusters in June, 1915. Barrio Tapia, Malabon, Cavite.

FORM NO. 2

Fruit round-oblate; weight about 73 grams; length about 4.3 cm., diameter 5.3 cm.; stem proportionally large; base roundish; apex somewhat flat, with a small greenish, smooth area around the nak; surface plain, with very short, fine tomentum; color ochraceous-tawny, somewhat darker at base; rind rather thin, buff-colored, turning quickly to brown on exposure to air; texture firm; flesh around seed very juicy and sweet, with short, fine fibers; flavor of rind sweet, subacid and without astringent taste; aroma agreeable; seeds large, oblong, four or five developed; eating quality very good.

Samples from a tree at Mayondon barrio, Los Baños, Laguna. August, 1915.

FORM NO. 3

Fruit round-oblate; weight averaging more than 100 grams; length 5 cm.; stem rather large; base flattened, or slightly depressed at middle; apex flattened, with a small, greenish, smooth, depressed area around the nak; surface wrinkly with a rather coarse, long tomentum (velvety); color orange-yellow, tinged with green at base; rind buff, thick, rather tender; flesh around seed very juicy and sweet; flavor of rind sweetish, subacid, non-astringent; seeds rather small, four or five developed; aroma well developed; quality very good.

Samples obtained from one tree. College grounds, near the Silk House. August, 1915.

Spondias purpurea

Ciruela

The ciruela, like the chico, is another delicious fruit in the Philippines that merits a more extensive cultivation. Its flesh is wholesome and of excellent flavor. It withstands rough handling well, and can be shipped long distances. It sells at a good price in the home markets. One common defect of the fruit, however, is the large size of the seed, which is fibrous and hard. The seed is said to be commonly sterile. The ciruela is commonly affected by a destructive fruit maggot. This tree has the great advantage of growing readily from large cuttings, even of the size of fence posts. Indeed, it occurs more commonly in fence rows than elsewhere.

FORM NO. 1

Form roundish-oblong; length about 4.3 cm., diameter 3.5 cm.; stem short, about 0.35 cm. in diameter; base narrowly depressed; apex round; surface smooth, glossy, with slight, irregular depressions and four, or usually five, longitudinal furrows; color reddish-purple; flesh buff-yellow, very juicy; texture fine; the one seed large, about 1.9 cm. x 1.8 cm., very hard, and fibrous outside; flavor sweet, subacid, slightly aromatic and delicious; quality very good.

Samples obtained in Calamba, Laguna. May, 1915.

CONCLUSIONS

A wide range of variability exists among the forms of Philippine fruits. This range is wider in species propagated by seed. Even in vegetatively propagated species several distinct forms, which may be bud mutations, have been found. The forms in the vegetatively propagated species are generally good and they are more uniform in quality than the seedling forms. The unproductivity of a large percentage of

the trees, especially those that are of seedling origin, was in evidence throughout the examination of orchards and the search for forms.

Many excellent forms are now growing in the native orchards. These are very desirable material for commercial cultures, or for further improvement by breeding.

Chico: Forms No. 4 and 5 are especially recommended for a wider culture. Form No. 1 has fruits of excellent quality, but is not productive; another tree of a similar form has to be looked for. Forms No. 2 and 3 are less desirable than any of the other forms.

Guanabano: No forms which are of especial value for propagation have been found. However, Form No. 2 has a better dessert quality than No. 1.

Anona and Atis: No forms which are of especial value for propagation have been found.

Bignay: The form described is very recommendable.

Nangka: Form No. 2 is especially recommended for a wider culture. Forms No. 3 and 1 are somewhat inferior to No. 2 in the quality of the fruit, and much more so in size.

Limuran: No forms which are of especial value for propagation have been found.

Catmon and Kambog: Any of the forms described is good.

Mabolo: Forms No. 4 and especially No. 2 are very desirable for propagation. The other two forms described are much inferior in the dessert qualities of the fruit.

Sapote negro: No forms which are of especial value for propagation have been found.

Macopa: Forms No. 3a, 3b, and 1 are especially recommended for a wider culture. Form No. 2 is very undesirable.

Lanzon: Forms No. 4 and 5 are especially recommended for a wider culture, while Form No. 6 is a two-season fruiting form and should he propagated more widely also. Forms No. 1, 2, and 3 are inferior forms of lanzon.

Chico mamey: The form described is good, but more excellent forms may, perhaps, be brought from Tropical America.

Mango: Forms No. 2, 3, 6, 8 and 10 are the more desirable forms of mango found. They are all especially recommended for wide culture, as each of these forms has excellent qualities. The other forms described are inferior, although Form No. 5 has been suggested as a good seedling stock.

Guavas: Among the guavas listed, the following are the more desirable forms: Nos. 1, 2 7, 8, 10, 11, 14, 15, 19, 20, 21, 23, 24 and 25.

Santol: Forms No. 2 and 3 are especially recommended for propagation.

Ciruela: The form described is of the ordinary sort.

RECOMMENDATIONS

The establishment of improved varieties of fruit is one of the most urgent needs of fruit growing in the Philippines. Toward this end, a careful selection of the best native forms should be practiced. These are to be used as sources of buds or grafts for the propagation of new trees, or for the renovation of the tops of undesirable trees.

Fruit growers should recognize the many advantages of vegetative propagation and should learn the different methods of doing it. They should know the value of having standard and specialized varieties in commercial fruit growing. They should bear in mind that the selection of varieties is one of the most important factors in successful

production, because varieties are known to differ widely in the economic production and value of the crops grown from them, and because varieties have individual fitness or unfitness to a given soil and climate, to certain diseases and insect pests, to market demands, and to the growers themselves.

The writer gratefully acknowledges the kindness of Professor Charles F. Baker, Chief of the Department of Agronomy, in giving valuable suggestions and criticisms throughout the course of this study.

REFERENCES

1. Miller: *Economic Conditions in the Philippines* (1913) 128.
2. Strother: World's Work, July, 1915, p. 356.
3. Langworthy: *Use of Fruit as Food*, U. S. D. A., Farm. Bull. No. 293 (1915) 36.
4. Snyder: *Chemistry of Plant and Animal Life* (1910) 317.
5. Langworthy: *Use of Fruit as Food*, U. S. D. A., Farm. Bull. No. 293 (1915) 38.
6. Jaffa: *Nutrition Investigation Among Fruitarians and Chinese at the Cal. Agr. Expt. Sta.*, U. S. D. A., O. E. S. Bul. 107, (1091) pp. 11, 19.
7. Wester: *The Lamao Experiment Station*, Phil. Agr. Rev., VIII (1915) 74.

EXPLANATION OF THE PLATES, ILLUSTRATING MR. DE LEON'S PAPER

PLATE I

Fig. 1. Archas Sapota, Chico, Form No. 4. Natural Size.
2. Same: longitudinal section.
3. Eugenia javanica, Macopa, Form 3A. Natural Size.
4. Eugenia javanica, Macopa, Form 3B. Natural Size.
5. Diospyros discolor, Mabolo, Form No. 2. x ½.
6. Same: longitudinal section, showing absence of seeds.
7. Psidium Guajava, Guava, Form No. 2. Natural Size.
8. Same: transverse section.
9. Lansium domesticum, Lanson, Form No. 4. x ½.
10. Same: transverse section, x 1, showing absence of seeds.

PLATE II

Artocarpus integrifolia, Jack-Fruit, much reduced.

PLATE III

Fig. 1. Antidesma Bunius, Bignay, Fruit Cluster, x ½.
2. Annona muricata, Guanabano. Form No. 1. x ½.
3. Dillenia philippinensis, Catmon, Form No. 3. x ½.
4. Same: after removal of calyx, showing carpels.
5. Calamus....., Limuran, x ½.

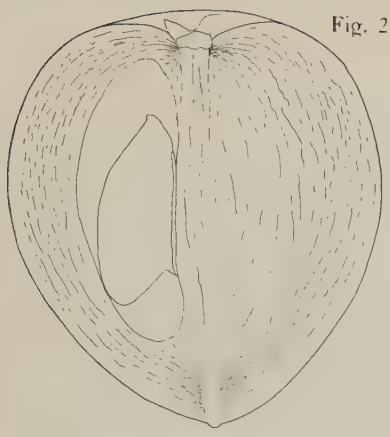


Fig. 2

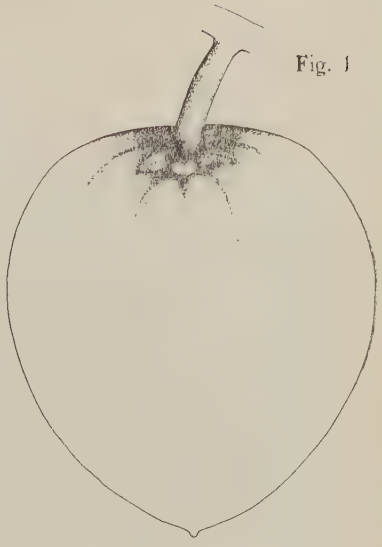


Fig. 1

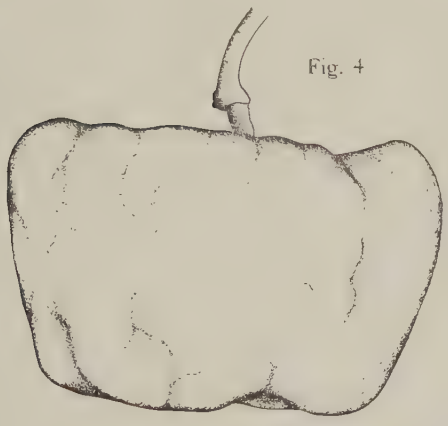


Fig. 4

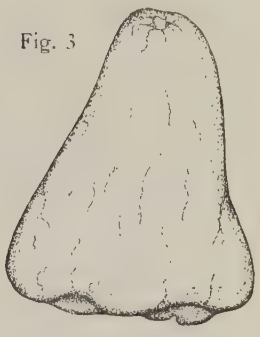
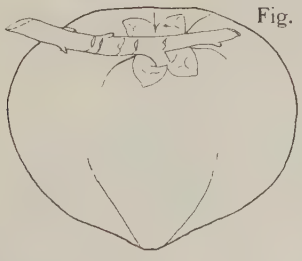


Fig. 3



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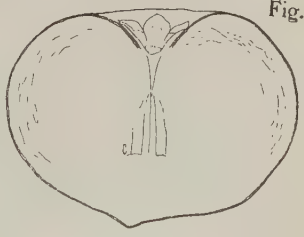

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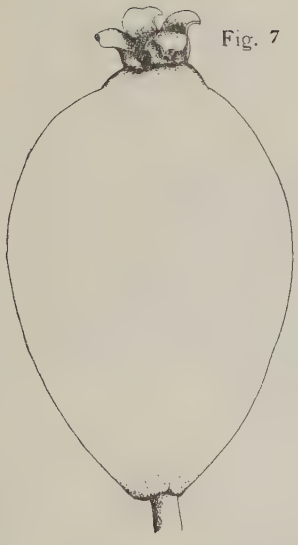

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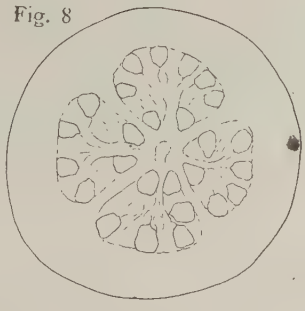

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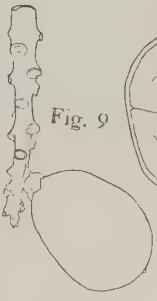

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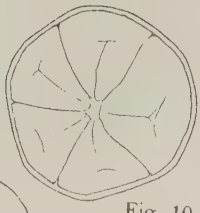


Fig. 10

PLATE I

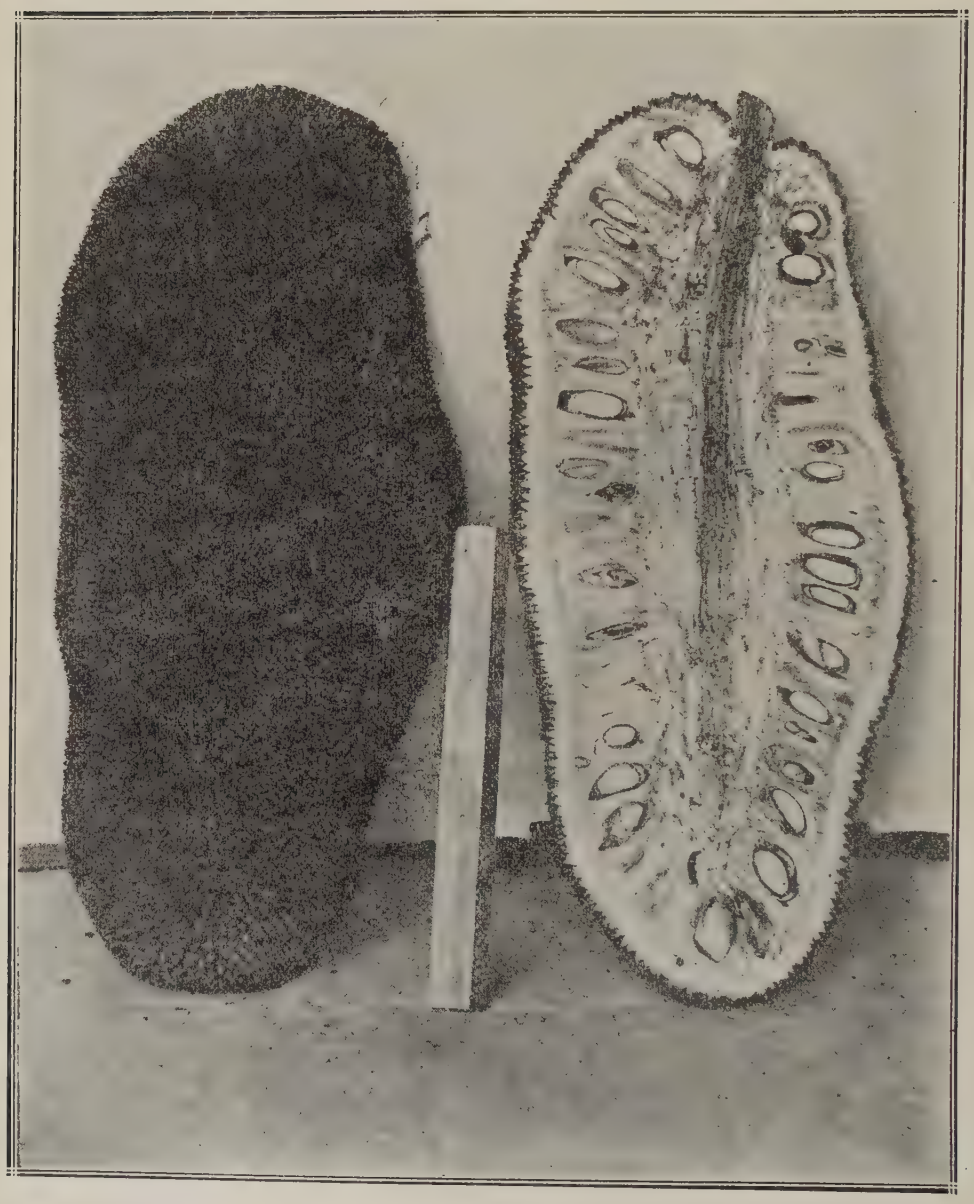


PLATE II

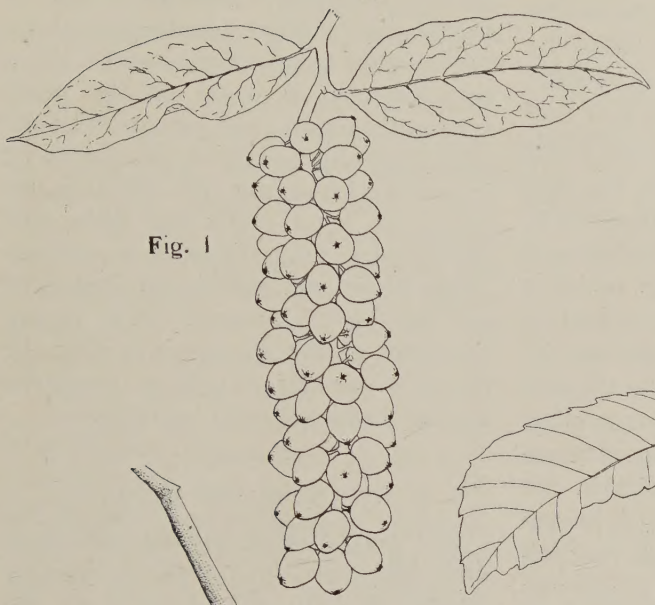
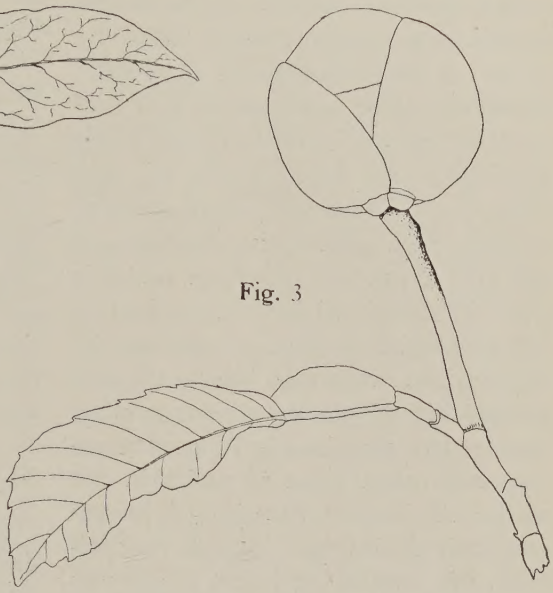


Fig. 1



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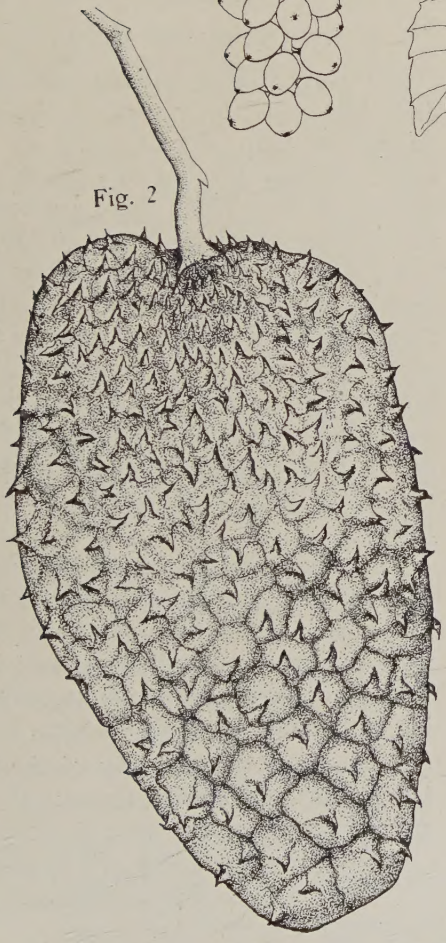

Fig. 2

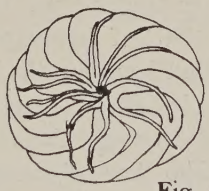

Fig. 4

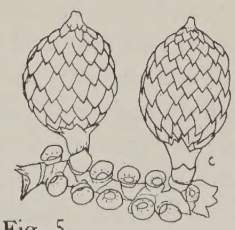

Fig. 5

PLATE III

Current Literature

FIGHTING INSECTS WITH FUNGI

The success which has attended attempts to control insect pests by means of their enemies is constantly attracting wider attention to this field of effort, and has in various places made men anticipate that success by such methods is something almost certain; whereas, as a matter of fact, efforts of this kind are at best uncertain, and it is only the occasional brilliant success at low cost which makes such experiments worth while. As a rule, insects are used to parasitize or otherwise destroy other insects, but occasionally fungous parasites are called upon to assist in the work. A fungous parasite of locusts in South Africa has seemed very effective in controlling locust plagues at home, but proved ineffective when attempts were made to import it to Australia and by the Philippine Government.

Another fungus found efficient in controlling the leaf hoppers in cane fields in Trinidad has recently been tested by Rutgers in Java.* His material was obtained through the entomologist F. Muir, who has distinguished himself in such work in Hawaii. This fungus is at present called *Metarrhizum anisopliae*, but has also been ascribed to the genera *Oospora*, *Entomophthora*, *Isaria*, and *Penicillium*. It is indigenous to Java where it occasionally attacks a wide variety of insects. Working with the imported strain supposed to be more powerfully pathogenic than the native, Rutgers found that under favorable conditions in the laboratory it was decidedly destructive when sprinkled in large doses on locusts and on *Leucopholis rorida*, an insect pest of Cassava. Under different conditions it proved practically harmless, even in the laboratory where quantities of spores were applied to individual insects. From the fact that it could not be made constantly fatal in the laboratory, Rutgers naturally concludes that nothing is to be expected from it in the field, unless there be a really favorable concatenation of natural conditions,—something which can neither be controlled nor anticipated by man. Tests of the efficiency of this fungus in killing the larvae of *Oryctes rhinoceros*, the black coconut beetle, are still being made.

* Mededeelingen van het Laboratorium voor Plantenziekten, No. 25, 1916.

QUININE IN JAVA

The Government quinine project in Java has issued its report for the final quarter of 1916, showing that on the seven stations devoted to quinine production in West Java, there are now in their permanent places nearly 10,000,000 trees, with four and three-quarters millions more in nurseries. While more than three-fourths of the older trees are *Cinchona ledgeriana*, in the nurseries there are less than one million of this species as compared with more than a million and a half hybrids produced in Java, and more than 2,000,000 of *C. succirubra*.

The sales of bark during 1916 amounted to more than nine hundred metric tons. Beside the income from this bark, there were comparatively small receipts from the sale of seeds and seedlings, amounting altogether to 14,000 florins.

A study of the viability of the seed has given the following result:

Kind of Seed	*In fresh condition*	*After 11 months at 30% relative humidity*	*After 11 months at 80% relative humidity*	*After 11 months at 92% relative humidity*
Ledgeriana..	99%	98%	72%	0
Succirubra..	95%	94%	59%	0
Hybrid.....	96%	94%	77%	0

NEW BOOKS ON COCONUT

The development of the culture of the coconut finds striking expression in the appearance during 1916 of two fairly imposing volumes, each dedicated to this industry in a particular region.

A PRACTICAL GUIDE TO COCO-NUT PLANTING by Munro and Brown, published by John Bale, Sons & Danielsson, London, deals essentially with the coconut industry of the Federated Malay States, with subordinate attention to Sumatra and Borneo. The authors are evidently familiar with the practice rather than the theory (if there be any difference) of coconut planting, and have prepared their book specifically for the use of the "common farmer." The attempt to avoid repelling the practical planter by the use of the language of the laboratory has resulted in places in the use of language which is even more plain than elegant. The real common sense of the authors finds expression, where it may not at first be recognized, in occasional uncertainty and apparent contradiction. As a matter of fact, the same practice is of course not to be recommended everywhere, and a careful study of the opinions and advice presented by these authors leaves the reviewer satisfied that almost every statement, even where the statements do not agree, is based on experience and is accordingly good. And there are opinions, usually expressed with confidence, on almost every question which could occur in coconut planting. In one of these questions, which has sometimes been relegated too much to the theoretical, they state (p. 28): "We are quite satisfied also that the age of the parent tree has little to do with the offspring's yielding capacity."

In the same chapter it is stated that "The results of observation show that as a rule nuts taken from trees growing on thoroughly well-drained land contain a thicker layer of meat and a higher percentage of oil than those taken from trees on swampy soil or land that is subject to constant flooding, ..." Contradicting the whole prejudice against heavy soils, these authors maintain that the best production over long periods is usually obtained on soils of decidedly firm character; and in this view those who have seen extensive coconut industries in other parts of the world will probably all agree. One of the best chapters is that on cover crops. In the treatment of pests and diseases the authors were on less familiar ground, and apparently did their work less carefully, at least as to the minor diseases. When *Helmithospodium* appears in the place of *Helminthosporium*, one is not surprised to find that it is recognized as a pest attacking young plants; whereas, so far as published reports are known to the reviewer, it is rather a saprophyte, following attacks by other fungi. The most notable single feature of the book is the wealth of illustrations. Many of these are excellent and altogether they give to the eye such an idea of various points of interest in the coconut industry as it has not been possible to obtain from any book previously published.

COCOS NUCIFERA, by Dr. F. W. T. Hunger, published by Scheltema & Holkema's Boekhandel, Amsterdam, is a handbook for the knowledge of the coconut palm in the Dutch Indies. It deals at some length with the botany of the coconut palm and with its history. The treatment of cultural questions is well arranged but not exceedingly complete. The photographs reproduced in this book make it a veritable work of art; and with full appreciation of the author's creditable achievement it may still be said that the publisher is entitled to far more than his usual share of pride in the product.

After reading both of these books, one wonders if more careful attention to information on the coconut industry of other couutries might not perhaps have made them more valuable in an altogether practical way to the people of the region to which they particularly apply.

Third Agricultural Congress of the Philippines

We have at hand a circular letter from Mr. M. A. Gonzalez, Secretary-Treasurer of the Agricultural Congress of the Philippines, calling attention to the act of the society naming *La Opinion* as its official organ, to which the members may look for news on the progress made by the permanent committee appointed to see that the resolutions passed are given due consideration by the Philippine Legislature now in session.

The members of the permanent committee do not receive any compensation for their work. On the other hand, this committee service carries with it its incidental expenses, as clerical, travel, postage, etc., all of which are likely to persuade the committeemen to be inactive.

Mr. Gonzalez reminds the members of their annual dues of ₱10.00, which may be sent to him at 850 Santol Street, Santa Mesa, Manila. At the same time, he invites people interested in the agricultural development of the country to become members of the society.